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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference W 5874-167 LB	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/EP 03/11938	International filing date (day/month/year) 03.11.2003	Priority date (day/month/year) 13.01.2003
International Patent Classification (IPC) or both national classification and IPC H03F1/32		
<b>CORRECTED VERSION</b>		
Applicant TELEFONAKTIEBOLAGET LM ERICSSON (PUBL) ET AL.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
- These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:
- I ☒ Basis of the opinion
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the international application
  - VIII ☐ Certain observations on the international application

Date of submission of the demand  02.07.2004	Date of completion of this report  20.05.2005
Name and mailing address of the International preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer  Jepsen, J  Telephone No. +31 70 340-3746 

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP 03/11938

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, Pages

1-17 as originally filed

### Claims, Numbers

1-9, 12-19 received on 10.03.2005 with letter of 07.03.2005

### Drawings, Sheets

1-5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/EP 03/11938

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	2-4, 8,9,12-19
	No: Claims	1, 5-7
Inventive step (IS)	Yes: Claims	
	No: Claims	2-4,8,9,12-19
Industrial applicability (IA)	Yes: Claims	1-9,12-19
	No: Claims	

2. Citations and explanations

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP 03/11938

**Re Item I**

**Basis of the report**

No claims 10 or 11 were filed.

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

Reference is made to the following document/s/ which were cited in the search report:

- D1: US-B1-6 373 902 (HA JI-WON ET AL) 16 April 2002 (2002-04-16)
- D2: US-A-5 903 823 (MORIYAMA YUKIHIRO ET AL) 11 May 1999 (1999-05-11)
- D3: EP-A-0 982 849 (NIPPON ELECTRIC CO) 1 March 2000 (2000-03-01)
- D4: US-A-6 072 364 (GHANNOUCHI FADHEL M ET AL) 6 June 2000 (2000-06-06)
- D5: EP-A-1 107 449 (NIPPON ELECTRIC CO) 13 June 2001 (2001-06-13)
- D6: EP-A-0 973 307 (MATSUSHITA ELECTRIC IND CO LTD) 19 January 2000  
(2000-01-19)

1.

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of **claim 1** is not new in the sense of Article 33(2) PCT.

The document D3 discloses with reference to figure 1 all the features of claim 1 (the references in parentheses applying to this document):

A device for predistorting an input signal (I<sub>r</sub>, Q<sub>r</sub>) at an amplifier means (10,11), comprising a storage means (14), offset adding means and a controller (15,16,30), further defined by  
the storage means (14) is adapted to store phase values, and  
the offset adding means is a phase offset adding means (20) for phase shifting the input signal,  
wherein the storage means (14) and the phase offset adding means (20) are

connected to the controller (15,16,30), which is adapted to retrieve at least one phase value from the storage means (14), and output an offset signal (Re, Im) comprising the retrieved phase value to the phase offset adding means (20), which is adapted to add said offset signal (Re, Im) to the input signal (Ir, Qr).

With respect to the above it can be added that although discrete phase jumps caused by changes in power control settings may not be specifically mentioned in D3 it is considered that D3 does disclose suitable multipliers as it is stated to cancel distortion based on different power control settings and such distortion is generally known to comprise both amplitude and phase components. The reason that D3 does not specifically mention phase values appears to be that the multiplexers are driven with rectangular coordinates whereas the present application refers to polar coordinates where the amplitude part is unity and the phase part is adjusted. Rectangular coordinates and polar coordinates are well known equivalent ways of representing the same information. The offset signal (Re, Im) in D3 hence is a phase value.

2.

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of dependent claims 2-4 does not involve an inventive step in the sense of Article 33(3) PCT.

In particular the subject-matter defined by claims 2-4 is considered obvious in the light of document D3 when taken alone.

**For claim 2:** The different gain levels are known from D3 (see in particular gain control signal (Gc) in figure 1). Their specific arrangement in a lookup table is an obvious choice.

**For claim 3:** Storing absolute or differential values are obvious choices that the man skilled in the art would make depending on the circumstances.

**For claim 4:** Rewritable memory is a standard manner of achieving flexibility. It does not lead to any surprising or synergetic effects.

3.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/EP 03/11938

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of dependent claims 5-7 is not new in the sense of Article 33(2) PCT.

The subject-matter of **claim 5** is known from D3 see complex multiplier (20) in figure 1.

The subject-matter of **claims 6 and 7** appears to merely recite the definition of predistortion.

4.

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of dependent claims 8 and 9 does not involve an inventive step in the sense of Article 33(3) PCT.

The subject-matter of **claim 8** defining the use of temperature dependent predistortion is shown in D2, fig. 50, see temperature sensor (65). Starting from D2 the man skilled in the art would look for other predistortion circuits that could benefit from temperature compensation. He would find D3 and in combining their teaching come to the subject-matter of claim 8. Also D1 shows a temperature sensor (229)

The combination of the documents D2 and D3 also shows to use frequency dependent predistortion according to **claim 9** (see (67) in D3, figure 50).

5.

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 12-19 is not new in the sense of Article 33(2) PCT or does not involve an inventive step in the sense of Article 33(3) PCT.

Claims 12-16 are method claims equivalent to at least some of claims 1-9 which do also not appear to meet the criteria of the PCT for the same reasons.

Claims 17-19 defining the use of the known devices and methods claimed in claims 1-16 in specific telecommunications devices is considered to be obvious because they do not produce any unexpected synergetic effects when so used.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/EP 03/11938

6.

The following documents cited in the search report are also considered to deprive claim 1 of novelty and/or inventive step:

- D4: Amplitude and phase look up tables. The fact that the circuit is an adaptive predistorter is irrelevant. The power control would be via the amplitude of the input signals.
- D5: Also amplitude and phase predistortion based on a signal from the transmission power controller.
- D6: Although not directly related to solving the problem of phase predistortion it discloses in par. [0006] - [0008] with reference to Figure 17 the necessity of distortion compensation to take into account power level changes.

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## Claims

1. A device for predistorting an input signal at an amplifier means (30), comprising a storage means (51), an  
5 offset adding means (50), and a controller (52),  
characterized in that

the storage means is adapted to store phase values;  
and

the offset adding means is a phase offset adding  
10 means for phase-shifting the input signal,

wherein the storage means (51) and the phase offset  
adding means (50) are connected to the controller (52),  
which is adapted to retrieve at least one phase value from  
the storage means, and output an offset signal comprising  
15 the retrieved phase value to the phase offset adding means  
(50), which is adapted to add said offset signal to the  
input signal.

2. The device according to claim 1, wherein the  
20 storage means comprises a lookup table (53a, 53b, 53c)  
comprising different gain levels and associated phase  
values, and the controller (52) is adapted to retrieve a  
phase value from the storage means (51) corresponding to a  
given gain level of the amplifier means (30).

25

3. The device according to claim 1, wherein the  
storage means (51) is a memory comprising a look-up table  
(53a, 53b, 53c) comprising phase values relating to the  
change of the gain level of an amplifier means (30) from a  
30 first gain level to one or more additional gain levels.

4. The device according to claim 3, wherein the  
memory is rewritable.



5. The device according to claim 1, wherein the phase offset adding means (50) is a complex multiplier.

6. The device according to claim 1, wherein each  
5 phase value stored in the storage means (51) corresponds to the change in phase of the output power when the gain level of the amplifier means (30) is changed from a first gain level to a second gain level.

10 7. The device according to claim 6, wherein the first gain level is the lowest gain level, and the second gain level is any other gain level of the amplifier means (30).

8. The device according to claim 1, wherein the  
15 device further comprises a temperature sensing means (60) connected to the controller (52) for deriving a temperature or a temperature interval, and the storage means (52) comprises a lookup table (53a, 53b, 53c) comprising gain levels and associated phase values for different  
20 temperatures or different temperature intervals, and the controller (52) is adapted to retrieve a temperature dependent phase value from the storage means (51) corresponding to a temperature or temperature interval and a given gain level of the amplifier means (30).

25 9. The device according to claim 1, wherein the device further comprises a frequency indicator (70) for deriving an operating frequency value or an operating frequency interval value, and the storage means (52) comprises a lookup table (53a, 53b, 53c) comprising gain  
30 levels and associated phase values for different frequencies or different frequency intervals, and the controller (52) is adapted to retrieve a frequency dependent phase value from the storage means (51)

corresponding to a frequency or frequency interval and a given gain level of the amplifier means (30).

12. A method for predistorting an input signal at an amplifier means (30) comprising a storage means (51),  
5 characterized by the steps of:

retrieving a phase value from a lookup table (53a, 53b, 53c) of the storage means (51) in response to changing the gain level of the amplifier means (30); and

10 adding an offset signal having a phase value corresponding to the retrieved phase value to said input signal.

13. The method according to claim 12, wherein the  
15 step of retrieving further comprises the steps of:

receiving a new gain level of the amplifier means (30); and

retrieving a phase value associated with the new gain level from the look-up table (53a, 53b, 53c) of the storage  
20 means (51).

14. The method according to claim 12, wherein the phase value corresponding to the basic gain level is zero.

25 15. The method according to claim 13, wherein the step of retrieving further comprises the steps of:

obtaining a temperature value or a temperature interval value; and

retrieving a temperature dependent phase value  
30 associated with the new gain level and the temperature or temperature interval from the lookup-table (53a, 53b, 53c) of the storage means (51).

16. The method according to claim 13, wherein the  
35 method comprises the further steps of:

obtaining a frequency value or a frequency interval value; and

retrieving a frequency dependent phase value associated with the new gain level and the frequency or  
5 frequency interval from the look-up table (53a, 53b, 53c) of the storage means (51).

17. An electronic apparatus comprising a device (46) for predistorting an input signal at an amplifier means  
10 (30) according to any of the claims 1-11.

18. The apparatus according to claim 17, wherein said equipment is a mobile terminal, a pager, or a communicator.

15 19. The apparatus according to claim 17, wherein the equipment is a mobile telephone.